

who had no previous knowledge of it would be bewildered. No pure mathematician could be more careless as to what the equations which he desires to write down are based upon, or show less interest in the question whether the results to which they lead are verified. Moreover, he does not explicitly refer to the base, relative to which the motions studied are reckoned, according to the theory which he is using, or appear to take any interest in the remarkable fact that the observed motions of bodies define such a base, which presumably has some relation to other physical phenomena. The only occasion on which he attempts to deal with the foundations of the subject is in connection with the law of action and reaction in statics, the treatment of which is clumsy and unconvincing, perhaps even unintelligible.

As in the case of the rest of physics, there are two ways of looking at mechanics, each of which has its own proper place. One is to regard all parts of the subject as coordinated by means of a generalisation which is as comprehensive as possible. The other is to aim rather at isolating the points involved in the subject, so that any degree of independence which they possess may be recognised, and so that it may as much as possible be seen how far the most precisely ascertained results carry us, and whether a doubt cast on any particular doctrine affects the whole foundation of the subject or not. Though the attainment of the former is the constant aim of scientific study, the latter is the proper attitude in which to approach it, and it seems to be a mistake to write the first chapter of physics in a different spirit.

W. H. M.

CANNIZZARO'S COURSE OF CHEMICAL PHILOSOPHY.

Sketch of a Course of Chemical Philosophy. By Stanislaio Cannizzaro (1858). Alembic Club reprints, No. 18. Pp. iv+55. (Edinburgh: The Alembic Club, 1910.)

THE Alembic Club have done well at this juncture to publish a translation of Cannizzaro's famous letter to De Luca—a letter which, to use Davy's phrase in connection with an equally memorable pronouncement, acted like an alarm-bell on Europe. Indeed, now that he has joined the majority, no more fitting monument to the perspicacity and genius of the great Italian chemist could be conceived than the publication, in the form of an admirably executed translation, of that statement of doctrine which astonished and ultimately convinced the chemical world of the mid-Victorian epoch.

To the chemists of the present age it is hardly possible to convey an idea of the profound sensation which this letter created. The effect was immediate and irresistible. At that time the name of Cannizzaro was hardly known beyond a limited circle of French and Italian men of science. With the appearance of the message came the conviction that a Daniel had come to judgment—that a prophet and a law-giver had arisen amongst us. The middle period of the last century was a time of political ferment

and social unrest, and here and there it culminated in revolution. It was equally a period of disturbance and upset in other spheres of human activity than politics and sociology. In chemistry, more perhaps than in the case of any other science at that time, the old order was changing, but the process was destructive rather than constructive. Old faiths were being undermined and thrown down, but the new dogmas had not stability enough to supplant them.

Cannizzaro's letter appeared at what, in the cantphrase, is termed the psychological moment. It brought order, method, and arrangement into what hitherto had been a mass of inconsistency and contradiction. Its logic was so clear, its appeal to history and to well-ascertained fact so irrefutable, its statement of proof so admirably marshalled, that criticism was silenced, and the doubter disarmed. Before a decade had passed its principles were everywhere accepted, and it is not too much to say that Cannizzaro effected a revolution in chemical thought as momentous in its way as the revolution he was subsequently concerned in bringing about in the political development of Italy.

To the student of chemistry it would be superfluous to enter into an analysis of Cannizzaro's letter, as its principles are now intimately woven into the web of modern chemical doctrine. Indeed, so indissolubly associated is the fundamental basis of Cannizzaro's chemical philosophy with the chemical philosophy of to-day that the statement of these principles, or of the course of argument upon which they are based, would have the semblance of a platitude. But we can assure the student that, however familiar he may be with the outcome of the doctrine with which the name of Cannizzaro will be imperishably connected, he will read with admiration and delight the *pronunciamento* in which the Genoese chemist makes known to his friend and colleague, and through him to the world, the dogma of what was henceforth to be the new chemistry—with admiration for the extraordinary perspicacity and conviction of its argument, and with delight at the simplicity and force of its statement.

T.

PRUNING OF FRUIT TREES.

Fruit Tree Pruning. A Practical Text-book for Fruit-growers working under the Climatic and Economic Conditions prevailing in Temperate Australia. By George Quinn. Pp. vi+230. (Adelaide, Australia: R. E. E. Rogers, Acting Government Printer, 1910.) Price 1s. 3d.

THE pruning of fruit trees is an operation that demands, on the part of the operator, first, an intimate knowledge of the natural habits of the particular trees, and, in the second place, considerable experience of the general results which follow a proper system of pruning. Unfortunately, every gardener and amateur who cultivates ever so few trees gets the conviction that, come what will, he must prune, and, if he is ignorant of the methods, nevertheless he mutilates the branches and imagines that his trees will respond satisfactorily to the treatment given

them. In these circumstances it is not to be wondered at if the value of pruning in any form or degree has come to be questioned by certain fruit-growers and experimentalists, who have had very little difficulty to expose all parts of the tree to the sun and of diminishing the crop.

It still remains incontrovertible, however, that young trees are benefited by a moderate degree of pruning if this is carried out by intelligent operators possessing the knowledge and experience necessary for the task. Such pruning is necessary for forming a proper foundation for the tree, for the removal of cross-branches, and the thinning out of the centre in order to better expose all parts of the tree to the sun and air.

This volume, prepared by the horticultural instructor for the Department of Agriculture, South Australia, under the direction of the Hon. Minister of Agriculture, is issued for the purpose of teaching the technique of pruning to fruit-growers having to work under the climatic and economic conditions prevailing in temperate Australia. The author's qualifications for teaching are clearly shown in his sensible and pertinent remarks upon the facts on which the theory of pruning is based, and his description of the objects the pruner seeks to obtain. Having instructed the reader in these matters, he describes the opposite effects of winter and summer pruning, the parts of a tree, and their different values; also the forms of tree to be encouraged, and the best means of developing fruit-bearing wood in place of foliaceous but barren branches. He next passes to a description of the specific treatment of different kinds of fruit, including apricot, plum, cherry, almond, peach, apple, pear, quince, fig, orange, lemon, and loquat.

There are 200 illustrations from photographs, most of these being valuable as a means of explaining the text, but others are inferior, and their omission would not have detracted from the appearance of the volume.

UNCONSCIOUS MEMORY.

Unconscious Memory. By Samuel Butler. New edition. With an Introduction by Prof. Marcus Hartog. Pp. xxxvii+186. (London: A. C. Fifield, Clifford's Inn, E.C., 1910.) Price 5s. net.

IT is probable that Butler will live in history as the writer of "Erewhon," but his more serious works, dealing with what may be called the philosophical side of biology, are still worth reading, and Mr. Fifield's re-issue will be welcomed by many. The volume under review consists partly of rather personal polemic against Darwin, and partly of a further development of Butler's views as expressed in his "Life and Habit." These views may be summarised as follows.

It is a fact of hourly observation that practice makes things easy which once were difficult (*e.g.*, the playing of a sonata), and even results in their being done without consciousness of effort. It follows that the fact of an intricate action being done unconsciously is an argument for the supposition that it must have been done repeatedly already. Now take the case of

a newly-hatched chicken, which pecks at once and perfectly. How is this? It is because something in the chicken remembers having pecked before, and consequently knows how to do it. An individual is not a new being; it—or part of it—has existed in the bodies of its parents. Thus heredity is memory. Cells remember what they have done before, and know how to do it again.

This, followed to its conclusion, involves the attribution of some kind of intelligence even to atoms. Indeed, we can hardly avoid it. Atoms have their likes and dislikes. Carbon and oxygen are sociable, fluorine is reserved and stand-offish. "The distinction between inorganic and organic is arbitrary." (This view is closely akin to that of Haeckel.) All action is purposive and intelligent. When an organism develops a new quality, it is because the organism has felt the need of it. Evolution is therefore teleological from within; differentiation of species, and variations of all kinds, are not entirely due (or as much as Charles Darwin supposed) to natural selection. Here Butler follows Buffon, Lamarck, and Erasmus Darwin.

Mr. G. Bernard Shaw has said that Butler was, in his department, the greatest English writer of the latter half of the nineteenth century; and, though he was only a *dilettante*, it is surprising how illuminating and suggestive his ideas seem, even now, thirty or forty years after first publication. It is noteworthy that Dr. Francis Darwin quoted him with special approbation in his presidential address before the British Association in 1908.

Prof. Marcus Hartog furnishes a useful introduction, discussing Butler's whole work and his place in the history of science.

The first edition of "Unconscious Memory" was reviewed in NATURE, January 27, 1881.

THE MAMMALS OF EUROPE.

Faune des Mammifères d'Europe. By Prof. E.-L. Trouessart. Pp. xvii+266. (Berlin: R. Friedländer and Sohn, 1910.) Price 12 marks.

IN issuing an up-to-date descriptive catalogue of the mammals of Europe Prof. Trouessart has conferred a real and lasting benefit on zoological science, since, owing to the great increase of species and races due to modern methods of discrimination, the well-known work of Blasius has long been practically useless. Indeed, if the two works be compared, it might at first sight be difficult to believe that they treat of the same subject, so great has been the increase in the last few years in the number of recognisably distinct forms, and so extensive the changes in nomenclature. Nowadays views differ—and will probably continue to differ—as to the limitations of species and races; but Dr. Trouessart appears inclined in most cases to use the former term in the most restricted sense. Justifying himself in doubtful instances by the dictum of Desmarest that "il est plus misable de trop réunir que de trop diviser," he might, if we remember rightly, have supported an opposite view by a statement of Huxley to the effect that it is more important to re-